REMARKS

Status of Claims

Claims 16-20 are allowed.

Claims 1, 3-9 and 11-20 are rejected.

Claim Rejections - 35 USC §103

Claims 1, 4-9, and 11-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakamoto (U.S. 6,097,138B1) in view of Dai et al. (US Patent 6,232,706 B1).

In response thereto, Applicants respectfully traverse the rejection of such claims and assert that the rejected claims are patentable.

Claim 1, as previously presented, recites in part:

A carbon nanotube-based field emission device comprising:

a cathode electrode; and

...the carbon nanotube array being aligned perpendicular to the cathode electrode with each given growth end embedded in the cathode electrode and the corresponding root end being outwardly directed and exposed;

... the root end thereof defines a planar surface with a flatness of less than one micron across the carbon nanotube array. (Emphasis added.)

Applicants submit that the device as set forth in previously presented claim 1 is neither taught, disclosed, nor suggested by Nakamoto '138, Dai et al. '706, or any of the other cited references, taken alone or in combination.

Nakamoto '138 discloses a method for manufacturing a field emission cold-cathode device. As shown in FIGs. 6A-6C, lines 5-29 of Nakamoto '138, the method mainly includes the following steps:

firstly, a carbon nanotube layer 26 is formed by depositing carbon on a cathode electrode 42;

secondly, the carbon nanotube layer 26 is pressed against a synthetic resin layer 44 in a molten state;

thirdly, the cathode electrode 42 is removed from the carbon nanotube layer 26 after the synthetic resin layer 44 is dried to form a support substrate 12; and

fourthly, a conductive material layer 46 serving as a cathode interconnecting layer is formed on the support substrate 12.

There is no specific disclosure or suggestion in Nakamoto '138 that the members of the carbon nanotbue layer 26 even particularly form a carbon nanotube array, as required in previously presented claim 1.

Even if the members of the carbon nanotube layer 26 can be interpreted as a carbon nanotube array, there is no specific disclosure or suggestion in Nakamoto '138 that the cathode electrode 42 has a flat surface and, moreover, that the members of the carbon nanotube layer 26 define a flat surface corresponding to the flat surface of the cathode electrode 42.

Furthermore, as admitted by the Examiner, there is no specific disclosure or suggestion in Nakamoto '138 that the exposed ends of the members of the carbon nanotube layer 26 thereof expressly defines "a planar surface with a flatness of less than one micron", which has been clearly provided in previously presented claim 1.

Dai et al. '706 discloses a method of making a field emission device 20. As shown in FIG. 3 and Col. 3, line 46-Col. 4, line 10 of Dai et al. '706, the method includes the following steps:

step A, a silicon substrate 22 is electrochemically etched to form a porous layer 24;

step B, catalytically active iron oxide patterns 26 are formed on the porous layer 24; and

step C, carbon nanotube bundles 28 are grown perpendicular to the substrate 22.

It is clear that the **exposed top surfaces** of the respective carbon nanotube bundles 28 **are actually the growth ends** thereof and **not the root ends**. **Even if** the exposed top surfaces of the respective carbon nanotube bundles 28 **could, for the sake of argument, be interpreted as root ends**, a flatness thereof is not expressly disclosed or even suggested to be less than one micron. The mere disclosure of a "flat" surface in Dai et al. '706 cannot, alone, be considered an inherent teaching or a suggestion of a specific degree of flatness, as is required by claim 1.

As set forth at MPEP 2143.03:

> "All words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970).

Essentially, Dai et al. '706 only expressly discloses flat-topped nanotube bundles. The **degree of flatness** required, as additional words in the claim, **must be given full weight**, and such a degree of flatness could, at most, be an inherent feature of Dai et al. '706 since the reference nowhere discloses or implies that such bundle tops are perfectly flat. In fact, if anything, at Dai et al. '706, at Column 4, lines 11-13, **teaches away from perfectly flat bundle tops**:

> "The ... method for making nanotube bundles **produces mainly flat-top bundles**, although sometimes bowl-shaped bundles are also produced." (Emphasis added.)

Applicant submits that "mainly flat-top bundles", taken in the context stated, **reasonably implies less than perfect flatness**. Thus, absent any statement to the contrary within Dai et al. '706, Applicant respectfully contends that, when considered as a whole, the reference does not inherently disclose or even suggest "a planar surface with a flatness of less than one micron across the carbon nanotube array", as per claim 1, and is thus unable to overcome the shortcomings associated with Nakamoto '138.

Furthermore, as set forth at MPEP 2141.02.V:

> Obviousness cannot be predicated on what is not known at the time an invention is made, even if the inherency of a certain feature is later established. *In re Rijckaert*, 9 F.2d 1531, 28 USPQ2d 1955 (Fed. Cir. 1993).

Thus, even if, for sake of argument, the surface of Dai et al. '706 is inherently flat to the degree required in claim 1, it still **would not have been**

obvious to modify Nakamoto '138 in such a manner **to provide for an inherent** (i.e., not specifically known) **feature** of Dai et al. '706.

To make a geographical analogy, I could say that both Indiana and Illinois are known to be "flat" States, especially compared to the Rocky Mountain or Appalachian States. However, it would be improper for me to conclude solely from that assessment that neither State might have some substantial hills and valleys, which obviously would not be true. In relation to both the ends of carbon nanotubes bundles 28 of the instant reference and the flat States, just knowing that they are accepted or disclosed as "flat" is not particularly a disclosure or suggestion, inherent or otherwise, of exactly how flat any of them are.

Simply put, Dai et al. '706, when considered as a whole, does not teach or suggest, with sufficient specificity, enough detail to meet the flatness limitation of claim 1, as previously presented, instead requiring an impermissible "obvious to try" (MPEP §2145.X.B.) standard to be implemented. Therefore, there is no specific disclosure or suggestion that, with respect to the carbon nanotube bundles 28 of Dai et al. '706, the exposed ends of the carbon nanotube bundles 28 are root ends and define a planar surface with a flatness of less than one micron, as is clearly set forth in previously presented claim 1.

Accordingly, Applicants submit that the combination of Nakamoto '138 in view of Dai et al. '706 fails to teach or suggest the carbon nanotube-based field emission device as set forth in previously presented claim 1. Therefore, previously presented claim 1 clearly recites novel and unobvious physical subject matter over Nakamoto '138 in view of Dai et al. '706 or any

of the other cited references, taken alone or in combination.

Applicants submit that the novel and unobvious physical features of claim 1 produce new and unexpected results over and above Nakamoto '138, Dai et al. '706 or any of the other cited references, taken alone or in combination. The new and unexpected results related to the claimed carbon nanotube-based field emission device are associated with the exposed flat root end of the carbon nanotube array. The exposed flat root end of the carbon nanotube array acts as electron emission ends of the carbon nanotube-based field emission device. Thus, this flat end effect improves electron emission uniformity and stability of the manufactured device and thus helps to overcome the shortcoming of the prior device whose electron emitting surface is neither predictable nor controllable (see Paras. **[0003]**, **[0006]** and **[0027]**). Applicants' invention is therefore clearly superior to that of Nakamoto '138, Dai et al. '706, or any of the other cited references, taken alone or in combination. The novel and unobvious features of Applicants' invention, which give effect to these results, are clearly recited in previously presented claim 1.

In summary, it is submitted that previously presented claim 1 is unobvious and patentable over Nakamoto '138, Dai et al. '706, or any of the other cited references, taken alone or in combination, under § 103.

Dependent claims 4-8, respectively, incorporate all the subject matter of independent claim 1 and add respective additional subject matter. As detailed above, it is asserted that previously presented claim 1 is allowable. Thus, it is submitted that the dependent claims 4-8 are also allowable, and

Applicants request that the rejection relating thereto be removed.

Claim 9, as previously presented, recites in part:

> A carbon nanotube-based field emission device comprising:
>
> ...a cathode electrode formed on and covering the growth end of the carbon nanotube array;
>
> wherein the root end defines a planar surface which is exposed outwardly and acts as an emitter, a flatness of the planar surface of the root end of the carbon nanotube array is less than 1 micron, and the growth end is embedded into the cathode electrode. (Emphasis added.)

Applicants submit that the device as set forth in previously presented claim 9 is neither taught, disclosed, nor suggested by Nakamoto '138, Dai et al. '706, or any of the other cited references, taken alone or in combination.

For reasons similar to those asserted above in relation to the rejection of claim 1 under 35 U.S.C. § 103 on Nakamoto '138 in view of Dai et al. '706, Applicants submit that subject matter as set forth in claim 9 is neither taught, disclosed, nor suggest by Nakamoto '138, Dai et al. '706, or any of the other cited references, taken alone or in combination.

Therefore, previously presented claim 9 is unobvious and patentable over Nakamoto '138, Dai et al. '706 or any of the other cited references, taken alone or in combination, under § 103.

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Dependent claims 11-15 incorporate all the subject matter of independent claim 9 and add respective additional subject matter. As detailed above, it is asserted that claim 9 is allowable. Thus, it is submitted that the dependent claims 11-15 are also allowable, and Applicants request that the rejection relating thereto be removed.

Claim 3 is rejected under 35 U.S.C. 103(a) as being anticipated over Nakamoto (U.S. 6,097,138B1) in view of Dai et al. (US Patent 6,232,706 B1) and in further view of Han et al. (U.S. 6,515,415B1).

Dependent claim 3 incorporates all the subject matter of independent claim 1, and adds respective additional subject matter. As detailed above, it is asserted that claim 1 is allowable. Thus, it is submitted that the dependent claim 3 is also allowable, and Applicants request that the rejection relating thereto be removed.

Allowable Subject Matter

Claims 16-20 are allowed.

Conclusion

For all the above reasons, applicants assert that all the pending claims are now in proper form and are patentably distinguishable over the prior art. Therefore applicants submit that this application is now in condition for allowance, and an action to this effect is earnestly requested.

Applicants further note that any new rejection in the next Office Action of any of the pending claims could not be considered as having been necessitated by amendment. Accordingly, Applicants respectfully submit that such an Office Action should not be made FINAL, based upon the guidelines set forth in MPEP §706.07(a).

Respectfully submitted,
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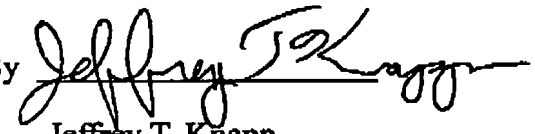
By 

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